NOTE: Adopt Title 13, California Code of Regulations, sections 2480 through 2489, to read as follows:

Chapter 9, Article 8. Verification Procedure, Warranty and In-Use Compliance Requirements for Retrofits to Control Emissions from Off-Road Large Spark-Ignition Engines

§ 2480. Applicability

These procedures apply to LSI retrofit emission control systems, which, through the use of sound principles of science and engineering, control emissions of oxides of nitrogen (NOx) and hydrocarbons (HC) from off-road large spark-ignition (LSI) engines. These systems may include but are not limited to, closed-loop fuel control systems, fuel injection systems, and three-way catalysts. These procedures are not applicable to retrofit strategies that employ or make use of fuel additives.

NOTE: Authority cited: Sections 39002, 39003, 39500, 39600, 39601, 39650-39675, 40000, 43000, 43000.5, 43011, 43013, 43018 and 43105, 43600, 43700, Health and Safety Code. Reference: Sections 39650-39675, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, and 43204-43205.5 Health and Safety Code; Title 17 California Code of Regulations Section 93000.

§ 2481. Definitions

(a) The definitions in Section 1900(b), Chapter 1, Title 13 of the California Code of Regulations are incorporated by reference herein. The following definitions shall govern the provisions of this chapter:
  (1) "Applicant" means the entity that has applied for or has been granted verification under this Procedure
  (2) "Average" means the arithmetic mean.
  (3) "Baseline" means the test of a vehicle or engine without the LSI retrofit emission control system implemented.
  (4) "Durability" means the ability of the applicant's LSI retrofit emission control system to maintain a level of emissions below the baseline and maintain its physical integrity over some period of time determined by the Executive Officer pursuant to these regulations. The minimum durability testing periods contained herein are not necessarily meant to represent the entire useful life of the LSI retrofit emission control system in actual service.
  (5) "Emergency Engine Repair" means repair conducted outside of normal scheduled maintenance that is required for the safe operation of the equipment.
  (6) "Emission control group" means a set of LSI engines and applications determined by parameters that affect the performance of a particular LSI retrofit emission control system. The exact parameters depend on the nature of the LSI retrofit emission control system and may include, but are

not limited to, baseline or certification levels of engine emissions, combustion cycle, displacement, aspiration, horsepower rating, duty cycle, exhaust temperature profile, and fuel composition. An applicant could specify an emission control group to be comprised of several different engine families and applications. Verification of an LSI retrofit emission control system and the extension of existing verifications is done on the basis of emission control groups

(7) "Executive Officer" means the Executive Officer of the Air Resources Board or the Executive Officer's designee.

(8) "Executive Order" means the document signed by the Executive Officer that specifies the verification level or percentage reduction of an LSI retrofit emission control system for an emission control group and includes any enforceable conditions and requirements necessary to support the designated verification.

(9) "LSI retrofit emission control system" means any device or system employed with an in-use off-road LSI-engine vehicle or piece of equipment that is intended to reduce emissions. Examples of LSI retrofit emission control systems include, but are not limited to, closed-loop fuel control system, fuel injection system, three-way catalysts, and combinations of the above.

(10) "LSI Retrofit Emission Control System Family Name." See Section 2486(c)(2).

(11) "Off-Road Large Spark-Ignition Engines" or "LSI Engines" means any engine that produces a gross horsepower 25 and greater or is designed (e.g., through fueling, engine calibrations, valve timing, engine speed modifications, etc.) to produce 25 and greater horsepower. If an engine family has models at or above 25 horsepower and models below 25 horsepower, only the models at or above 25 horsepower would be considered LSI engines. The engine's operating characteristics are significantly similar to the theoretical Otto combustion cycle with the engine's primary means of controlling power output being to limit the amount of air and fuel that is throttled into the combustion chamber of the engine. LSI engines or alternate fuel powered LSI internal combustion engines are designed for powering equipment applications including, but not limited to, forklift trucks, sweepers, generators, and industrial equipment and other miscellaneous applications. Specifically excluded from this category are: 1) engines operated on or in any device used exclusively upon stationary rails or tracks; 2) engines used to propel marine vessels; 3) internal combustion engines attached to a foundation at a location for at least 12 months; 4) off-road recreational vehicles and snowmobiles; and 5) stationary or transportable gas turbines for power generation.

(12) "Off-Road Vehicle" or "Off-Road Equipment" means any non-stationary device, powered by an internal combustion engine or motor, used primarily off the highways to propel, move, or draw persons or property including any device propelled, moved, or drawn exclusively by human

power. Examples include, but are not limited to, Marine Vessels, Construction/Farm Equipment, Industrial Equipment, Locomotives, Small Off-Road Engines, Off-Road Motorcycles, and Off-Highway Recreational Vehicles.

(13) "Otto Cycle Engine" means a type of engine with operating characteristics significantly similar to the theoretical Otto combustion cycle. The primary means of controlling power output in an Otto cycle engine is by limiting the amount of air and fuel that can enter the combustion chambers of the engine. As an example, gasoline-fueled and LPG engines are Otto cycle engines.

(14) "Revoke" means to cancel the verification status of an LSI retrofit emission control system. If an LSI retrofit emission control system's verification status is revoked by the Executive Officer, the applicant must immediately cease and desist selling the LSI retrofit emission control system to end-users.

(15) "Verification" means that after thoroughly evaluating a Retrofit Emission Control System for installation on in-use equipment an Executive Order is issued. This ensures the emission reductions achieved by the control strategy are real and durable and production units in the field achieve reductions consistent with the verification procedure.

NOTE: Authority cited: Sections 39002, 39003, 39500, 39600, 39601, 39650-39675, 40000, 43000, 43000.5, 43011, 43013, 43018 and 43105, 43600, 43700, Health and Safety Code. Reference: Sections 39650-39675, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, and 43204-43205.5 Health and Safety Code; Title 17 California Code of Regulations Section 93000.

§ 2482. Application Process

(a) Overview. Before submitting a formal application for the verification of an LSI retrofit emission control system for use with an emission control group, the applicant must submit a proposed verification testing protocol to ARB (pursuant to Section 2482(b)). To obtain verification, the applicant must conduct emission reduction testing (pursuant to Section 2483), durability testing (pursuant to Section 2484), and a field demonstration (pursuant to Section 2485), and must submit the results along with comments and other information (pursuant to Sections 2486 and 2487) in an application to the Executive Officer, in the format shown in Section 2482(d). If the Executive Officer grants verification of an LSI retrofit emission control system, he or she will issue an Executive Order to the applicant identifying the verified emission reduction and any conditions that must be met for the LSI retrofit emission control system to function properly. After the Executive Officer grants verification of an LSI retrofit emission control system, the applicant must provide a warranty, conduct in-use compliance testing of the system after having sold or leased a specified number of units, and report the results to the Executive Officer (pursuant to Section 2489). An LSI retrofit emission control

system that employs two or more individual sub-systems or components must be tested and submitted for evaluation as one system.

(b) Proposed Verification Testing Protocol. Before formally submitting an application for the verification of an LSI retrofit emission control system, the applicant must submit a proposed verification testing protocol to ARB. The proposed protocol should lay out the applicant's plans for meeting the testing requirements. The Executive Officer shall use the information in the proposed protocol to help determine the need for additional analyses and the appropriateness of allowing alternatives to the prescribed requirements. The proposed protocol should include the following information:

(1) Identification of the contact persons, phone numbers, names and addresses of the responsible party proposing to submit an application.

(2) Description of the LSI retrofit emission control system's principles of operation. A schematic depicting operation should be included as appropriate. It is the responsibility of the applicant to demonstrate that the product relies on sound principles of science and engineering to achieve emission reductions. The description of the LSI retrofit emission control system must include, at a minimum, the information described in section 2482(d), items 2 and 3.

(A) If, after reviewing the proposed verification testing protocol, the Executive Officer determines that the applicant has not made a satisfactory demonstration that its product relies on sound principles of science and engineering to achieve emission reductions, the Executive Officer shall notify the applicant of the determination in writing. The applicant may choose to withdraw from the verification process or submit additional materials and clarifications. The additional submittal must be received by the Executive Officer no later than 60 days from the date of the notification letter or the application may be suspended.

(B) If, after reviewing the additional submittal, the Executive Officer determines that the applicant has not yet made a satisfactory demonstration that its product relies on sound principles of science and engineering to achieve emission reductions, the application shall be suspended. If an application has been suspended, it may only be reactivated at the discretion of the Executive Officer.

(C) If at any time, the Executive Officer has reason to doubt the scientific or engineering soundness of a product, the Executive Officer may require the applicant to submit additional supporting materials and clarifications no later than 60 days from the date of the notification letter. If the additional submittal is not received by the Executive Officer by the deadline established in the notification letter, the application may be suspended. In deciding whether to suspend an application the Executive Officer will review submittals as provided in subsection (B) above.

(3) Preliminary parameters for defining emission control groups that are appropriate for the LSI retrofit emission control system. The Executive Officer will work with the applicant to determine appropriate emission control group parameters.
(4) The applicant's plan for meeting the requirements of Sections 2483-2486. Existing test data may be submitted for the Executive Officer's consideration. The proposed verification testing protocol must focus on verification of the LSI retrofit emission control system for use with a single emission control group
(5) A brief statement that the applicant agrees to provide a warranty pursuant to the requirements of Section 2487.

(c) After an applicant submits a proposed verification testing protocol, the Executive Officer shall, within 30 days of its receipt, determine whether the applicant has identified an appropriate testing protocol to support an application for verification and notify the applicant in writing that it may submit an application for verification. The Executive Officer may suggest modifications to the proposed verification testing protocol to facilitate verification of the LSI retrofit emission control system. All applications, correspondence, and reports must be submitted to:

Air Resources Board
9528 Telstar Avenue
El Monte, CA 91731

(d) Application Format. The application for verification of an LSI retrofit emission control system must follow the format shown below. If a section asks for information that is not applicable to the LSI retrofit emission control system, the applicant must indicate "not applicable." If the Executive Officer concurs with the applicant's judgement that a section is not applicable, the Executive Officer may waive the requirement to provide the information requested in that section.

1. Introduction
   - 1.1 Identification of applicant, manufacturer, and product
   - 1.2 Identification of level of verification being sought
     - 1.2.1 Description of emission control group selected
     - 1.2.2 Emission reduction claim

2. LSI Retrofit Emission Control System Information
   - 2.1 General description of the LSI retrofit emission control system
     - 2.1.1 Discussion of principles of operation and system design
     - 2.1.2 Schematics depicting operation (as appropriate)
   - 2.2 Favorable operating conditions

2.3 Unfavorable operating conditions (e.g., inappropriate duty cycle or application, geographical limitations, etc.) and associated reductions in performance
2.4 Fuel requirements (e.g., fuel specifications) and misfueling considerations
2.5 Identification of failure modes and associated consequences
2.6 Complete discussion of potential safety issues *(e.g., lack of proper maintenance, unfavorable operating conditions, etc.)*
2.7 Installation requirements
2.8 Maintenance requirements

3. LSI Retrofit Emission Control System and Emission Control Group Compatibility
3.1 Compatibility with the engine
3.1.1 Discussion on calibrations and design features that may vary from engine to engine
3.1.2 Effect on overall engine performance
3.1.3 Effect on fuel consumption
3.1.4 Engine oil consumption considerations

3.2 Compatibility with the application
3.2.1 Dependence of calibration and other design features on application characteristics
3.2.2 Comparison of field-collected application data with operating conditions suitable for the LSI retrofit emission control system

4. Testing Information
4.1 Initial Emission reduction testing requirements
4.1.1 Test facility identification
4.1.2 Description of equipment and engine *(make, model year, engine family name, etc.)*
4.1.3 Test procedure description *(-pre-conditioning period, test cycle, etc.)*
4.1.4 Test results and comments

4.2 Durability emission testing requirements
4.2.1 Test facility identification
4.2.2 Description of field application (where applicable)
4.2.3 Description of equipment and engine *(make, model year, engine family name, etc.)*
4.2.4 Test procedure description *(field or bench, test cycle, etc.)*
4.2.5 Test results and comments
4.2.6 Summary of evaluative comments from third-party for in-field durability demonstration *(e.g., driver or fleet operator)*

4.3 Field demonstration requirements (where applicable)
4.3.1 Field application identification
4.3.2 Description of equipment and engine *(make, model year, engine family name, etc.)*

4.3.3 Summary of evaluative comments from third-party *(e.g., driver or fleet operator)*

4.4 Alternative In-Use Compliance Test Procedure (where applicable)
- 4.4.1 Description of the proposed alternative in-use test procedure
- 4.4.2 Description of test equipment, including measurement accuracy, precision, and repeatability
- 4.4.3 Description of advantages and limitations of the proposed alternative in-use test procedure
- 4.4.4 Description of the emission correlation of the proposed alternative in-use test procedure with emission results from engine dynamometer test conducted for verification of the LSI retrofit emission control system.
- 4.4.5 Test results and comments

5. References
6. Appendices
   - 6.1 Laboratory test report information *(for all tests)*
     - 6.1.1 Actual laboratory test data
     - 6.1.2 Quality assurance and quality control information
   - 6.2 Third-party letters or questionnaires describing in-field performance
   - 6.3 LSI retrofit emission control system label
   - 6.4 Owner's manual (as described in Section 2486 (e))
   - 6.5 Other supporting documentation

(e) Within 30 days of receipt of the application, the Executive Officer shall notify the applicant whether the application is complete.

(f) Within 60 days after an application has been deemed complete, the Executive Officer shall determine whether the LSI retrofit emission control system merits verification and shall classify it as shown in Table 1. The applicant and the Executive Officer may mutually agree to a longer time period for reaching a decision, and the applicant may submit additional supporting documentation before a decision has been reached. The Executive Officer shall notify the applicant of the decision in writing and specify the verification level or percentage reduction for the LSI retrofit emission control system and identify any terms and conditions that are necessary to support the verification.

(g) Extensions of an Existing Verification. If the applicant has verified an LSI retrofit emission control system with one emission control group and wishes to extend the verification to include additional emission control groups, it may apply to do so using the original test data, additional test data, engineering justification and analysis, and any other information deemed necessary by the Executive Officer to address the differences between the emission control group already verified and the additional emission control group(s). Processing time periods follow sections (e) and (f) above.

Table 1. LSI Engine Retrofit System Verification Levels

Classification	Percentage Reduction (HC+NOx) (Verified in 5% increments [1])	Absolute Emission Level (HC+NOx) (Verified in 0.5 g/bhp-hr increments)
LSI Level 1 [3]	≥ 25%	Not Applicable
LSI Level 2 [3]	≥ 75%[2]	3.0 g/bhp-hr
LSI Level 3a [3]	≥ 85%	0.5, 1.0, 1.5, 2.0, 2.5 g/bhp-hr
LSI Level 3b [4]	Not Applicable	0.5, 1.0, 1.5, 2.0 g/bhp-hr

Notes [1] Increments applicable to LSI Level 3a classifications only
[2] The allowed verified percentage reduction for LSI Level 2 is capped at 75% regardless of actual emission test values
[3] Applicable to uncontrolled engines only
[4] Applicable to emission-controlled engines only

(h) Design Modifications. If an applicant modifies the design of an LSI retrofit emission control system that has already been verified or is under 0consideration for verification by the Executive Officer, the modified version must be evaluated under this Procedure. The applicant must provide a detailed description of the design modification along with an explanation of how the modification will change the operation and performance of the LSI retrofit emission control system. To support its claims, the applicant must submit additional test data, engineering justification and analysis, and any other information deemed necessary by the Executive Officer to address the differences between the modified and original designs. An applicant must have written approval from the Executive Officer prior to making any design modifications to an LSI retrofit emission control system that has already been verified or is under consideration for verification by the Executive Officer. Processing time periods follow sections (e) and (f) above.

(i) Treatment of Confidential Information. Information submitted to the Executive Officer by an applicant may be claimed as confidential, and such information shall be handled in accordance with the procedures specified in Title 17,

California Code of Regulations, Sections 91000-91022. The Executive Officer may consider such confidential information in reaching a decision on a verification application.

(j) The Executive Officer may lower the verification level or revoke the verification status of a verified LSI retrofit emission control system if there are errors, omissions or inaccurate information in the application for verification or supporting information.

NOTE: Authority cited: Sections 39002, 39003, 39500, 39600, 39601, 39650-39675, 40000, 43000, 43000.5, 43011, 43013, 43018 and 43105, 43600, 43700, Health and Safety Code. Reference: Sections 39650-39675, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, and 43204-43205.5 Health and Safety Code; Title 17 California Code of Regulations Section 93000.

§ 2483. Initial Emission Testing Requirements

(a) The applicant must identify the emission control group and test the LSI retrofit emission control system on an emission control group basis. The applicant must identify the test engines and equipment, if applicable, by providing the engine family name, make, model, model year, HC and NOx baseline emission test levels, or HC and NOx certification levels if applicable. The applicant must also describe the equipment applications on which the LSI retrofit emission control system is intended to be used, by giving examples of in-use equipment, characterizing typical duty cycles, indicating any fuel requirements, and/or providing other application-related information.

(b) Engine Pre-conditioning. All testing should be performed with the test engine in a proper state of maintenance. The applicant may tune-up or rebuild test engines prior to, but not after, baseline testing, unless rebuilding the engine is an integral part of the LSI retrofit emission control system.

(c) LSI Retrofit System Pre-conditioning. The engine or equipment installed with an LSI retrofit emission control system must be operated for a break-in period of between 25 and 100 hours before emission testing.

(d) Test Fuel.

(1) The test fuel used shall be consistent with the fuel specifications as outlined in the "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium- Duty Vehicles," as adopted May 20, 1987, and last amended August 5, 1999, and incorporated by reference herein. If the engine is tested using the U.S. EPA test fuel, consistent with the fuel specifications as outlined in Title 40 CFR, Part 86, the manufacturer shall demonstrate that the emission test results comply with these Test Procedures.

(2) During all engine tests, the engine shall employ lubricating oil consistent with the engine manufacturer's specifications for that particular engine. These specifications shall be recorded and declared in the verification application.

(e) Test Cycle.

(1) Prior to 2007, the LSI retrofit emission control system must be tested using the steady-state test procedure (summarized in Table 2) outlined in the ARB off-road regulations (California Code of Regulations, Title 13, Section 2433 and the incorporated California Exhaust Emission Standards and Test Procedures for New 2001 and Later Off-Road Large Spark-Ignition Engines), or the U.S. EPA transient test procedures as outlined in 40 CFR, part 1048, subpart F, or with an alternative cycle(s) approved by the Executive Officer pursuant to subsection (f) below. For off-road engines used in constant-speed operation, the applicant must use the most appropriate off-road test cycle representing the operating conditions of the application, with approval from the Executive officer, or the U.S. EPA transient test procedures as outlined in 40 CFR, part 1048, subpart F.

Table 2. Test Cycles for Emission Reduction Testing

Test Type	LSI Retrofit System Verification Date	Off-Road (including portable engines)	Off-Road (constant-speed operation)
Engine	Pre-2007	Steady-state test cycle (C2) from ARB off-road regulations or U.S. EPA transient test	Steady-state test cycle (D2) from ARB off-road regulations or U.S. EPA transient test
Engine	2007 and later	U.S. EPA transient test	U.S. EPA transient test

(2) Starting with the 2007 model year for all off-road engines, the LSI retrofit emission control system must be tested using the U.S. EPA transient test procedures as outlined in 40 CFR, part 1048, subpart F or with an alternative cycle(s) approved by the Executive Officer pursuant to subsection (f) below.

(f) Alternative Test Cycles and Methods. The applicant may request the Executive Officer to approve an alternative test cycle or method in place of a required test cycle or method. In reviewing this request, the Executive Officer may consider all relevant information including, but not limited to, the following:

(1) Similarity of characteristics to the specified test cycle or method and in-use duty cycle,
(2) Body of existing test data generated using the alternative test cycle or method,
(3) Technological necessity, and
(4) Technical ability to conduct the required test.

(g) Verification of NOx+HC Emission Reductions. A minimum of three hot-start tests for the test cycle selected from Table 2, or an Executive Officer-approved alternative test cycle, must be run for both baseline (without the LSI retrofit emission control system implemented) and control configurations.

(h) Results. For all valid emission tests used to support emission reduction claims, the applicant must report emissions of total hydrocarbons , oxides of nitrogen, and carbon monoxide. Emission test results must be reported in grams/brake horsepower-hour (g/bhp-hr).

(i) Incomplete and Aborted Tests. The applicant must identify all incomplete and aborted tests and explain why those tests were incomplete or aborted.

(j) Additional Analyses. The Executive Officer may require the applicant to perform additional analyses if there is reason to believe that the use of an LSI retrofit emission control system may result in the increase of toxic air contaminants, or other harmful compounds.
(1) In its determination, the Executive Officer may consider all relevant data, including but not limited to the following:
(A) The addition of any substance to the fuel, intake air, or exhaust stream,
(B) Whether a catalytic reaction is known or reasonably suspected to increase toxic air contaminants or ozone precursors,
(C) Results from scientific literature,
(D) Field experience, and
(E) Any additional data.
(2) The Executive Officer will determine appropriate test methods for additional analyses in consultation with the applicant.

(k) Quality Control of Test Data. The applicant must provide information on the test facility, test procedure, and equipment used in the emission testing, including evidence establishing that the test equipment used meets the specifications and calibrations given in the Code of Federal Regulations, Title 40, Part 86, subpart N.

(l) The Executive Officer may, with respect to any LSI retrofit emission control system sold, leased, offered for sale, or manufactured for sale in California, order the applicant to make available for testing and/or inspection a reasonable number of LSI retrofit emission control systems, and may direct

that they be delivered at the applicant's expense to the state board at the Haagen-Smit Laboratory, 9528 Telstar Avenue, El Monte, California or where specified by the Executive Officer. The Executive Officer may also, with respect to any LSI retrofit emission control system being sold, leased, offered for sale, or manufactured for sale in California, have an applicant test and/or inspect a reasonable number of units at the applicant or manufacturer's facility or at any test laboratory under the supervision of the Executive Officer.

NOTE: Authority cited: Sections 39002, 39003, 39500, 39600, 39601, 39650-39675, 40000, 43000, 43000.5, 43011, 43013, 43018 and 43105, 43600, 43700, Health and Safety Code. Reference: Sections 39650-39675, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, and 43204-43205.5 Health and Safety Code; Title 17 California Code of Regulations Section 93000.

§ 2484. Durability Emission Testing Requirements

(a) The applicant must demonstrate, to the satisfaction of the Executive Officer, the durability of the applicant's LSI retrofit emission control system through an actual field or laboratory-based demonstration test. If the applicant chooses a laboratory-based durability demonstration, an additional field demonstration will be required to demonstrate in-field compatibility (pursuant to Section 2485). If the applicant has demonstrated the durability of the identical system in a prior verification or OEM certification, or has demonstrated durability through field experience, the applicant may request that the Executive Officer accept the previous demonstration in fulfillment of this requirement. In evaluating such a request, the Executive Officer may consider all relevant information including, but not limited to, the similarity of baseline emissions and application duty cycles, the relationship between the emission control group used in previous testing and the current emission control group, the number of engines tested, evidence of successful operation and user acceptance, and published reports.

(b) Engine Selection. Subject to the approval of the Executive Officer, the applicant may choose the engine and application to be used in the durability demonstration. The engine and application must be representative of the emission control group for which verification is sought. The selected engine need not be the same as the engine used for the initial emission testing (pursuant to Section 2483), but if the applicant does use the same engine, the initial emission testing may also be used for the initial durability tests.

(c) Test Fuel.

(1) The test fuel used shall be consistent with the fuel specifications as outlined in the "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium- Duty Vehicles," as adopted May 20, 1987, and last amended August 5, 1999, and incorporated by reference herein. The

California fuel specifications are contained in the California Code of Regulations, Title 13, Chapter 5, Article 3, Sections 2290-2293.5. If the engine is tested using the U.S. EPA test fuel, consistent with the fuel specifications as outlined in 40 CFR, part 86, the manufacturer shall demonstrate that the emission test results complies with these Test Procedures.

(2) During all engine tests, the engine shall employ lubricating oil consistent with the engine manufacturer's specifications for that particular engine. These specifications shall be recorded and declared in the verification application.

(d) Service Accumulation. The durability demonstration consists of an extended service accumulation period in which the LSI retrofit emission control system is implemented in the field or in a laboratory, with emission reduction testing before and after the service accumulation Service accumulation begins after the first emission test and concludes before the final emission test. The pre-conditioning period required in Section 2483 (c) cannot be used to meet the service accumulation requirements

(1) Minimum Durability Demonstration Periods. The minimum durability demonstration period is 1,000 hours if it can be correlated or demonstrated to be equivalent to 2,500 hours in-use**.** Otherwise, the durability demonstration period is 2,500 hours) unless the Executive Officer approves a shorter durability demonstration period, upon the applicant's written request. The applicant must provide sufficient documentation to justify the request for a shorter durability demonstration period. The applicant may propose a sampling scheme that could be used to support an accelerated durability schedule for approval by the Executive Officer. The sampling scheme may include, but is not limited to, logging only significant changes in a parameter, averages, or changes above some threshold value. Data must be submitted electronically in columns as a text file or another format approved by the Executive Officer.

(2) Fuel for Durability Demonstrations. The fuel used during durability demonstrations should be equivalent to the test fuel, or a fuel with properties less favorable to the durability of the emission control strategy. Durability demonstrations may, at the applicant's option and with the Executive Officer's approval, include intentional misfueling events so that data on the effects of misfueling may be obtained.

(e) Third-Party Statement for In-field Durability Demonstrations. For in-field durability demonstrations, the applicant must provide a written statement from an Executive Officer approved third party, such as the owner or operator of the vehicle or equipment used, at the end of the durability period. The statement must describe overall performance, maintenance required, problems encountered, and any other relevant comments. The results of a visual inspection conducted by the third party at the end of the demonstration period must also be described. The description should comment on whether

the LSI retrofit emission control system is physically intact, securely mounted, or leaking any fluids, and should include any other evaluative observations.

(f) Test Cycle. Testing requirements are summarized in Table 3. Note that the same cycle(s) must be used for both the initial and final tests as defined in Section 2483.

Table 3. Emission Tests Required for Durability Demonstrations

Application	LSI Retrofit System Verification Date	Test Type	Initial Test (prior to service accumulation) Final Test (after completion of 100% of the service accumulation)
Off-Road and portable engines	Pre-2007	Engine	Steady-state test cycle from ARB off-road regulations or U.S. EPA transient test cycle or an alternative cycle
Off-Road and portable engines	2007 and later	Engine	U.S. EPA transient test cycle or an alternative cycle

(g) Test Run. The requirements for emissions reduction testing are summarized in Table 3, above.

(1) The LSI retrofit emission control system must undergo one set of emission tests before beginning and one set after completion of the service accumulation. If there are substantial test data from previous field studies or field demonstrations, applicants may request that the Executive Officer consider these in place of the initial emission tests.

(2) As an alternative to testing a single unit before and after the service accumulation period, the applicant may request that the Executive Officer consider the testing of two identical units, one that has been pre-conditioned and another that has completed the service accumulation period. In reviewing the request, the Executive Officer may consider all relevant information, including, but not limited to, the following:

(A) The effect of the LSI retrofit emission control system on engine operation over time. Strategies that cause changes in engine operation are likely not to qualify for this testing option.

(B) The quality of the evidence the applicant can provide to support that the two units are identical, and

(C) Previous experience with similar or related technologies

(h) Maintenance During Durability Demonstration. Except for emergency engine repair, only scheduled maintenance on the engine and LSI retrofit emission control system may be performed during the durability demonstration. If normal maintenance includes replacement of any component of the engine emission control system, the time (years or hours) between component change or refill must be reported with the results of the demonstration. If emergency repair was conducted on an engine equipped with the LSI retrofit emission control system within the durability demonstration period, the applicant must, within 30 days of the repair, report to the Executive Officer on what repair was performed and what components were involved, and provide an explanation on the possible cause(s) for the engine's and/or LSI retrofit emission control system's malfunction. Based on the information provided by the applicant, the Executive Officer will decide whether to allow that engine to continue to be used in the durability demonstration program, or to start anew the durability demonstration period.

(i) Performance Requirements. The LSI retrofit emission control system must meet the following requirements throughout the durability demonstration period:
   (1) If the applicant claims a percent emission reduction, the percent emission reduction must exceed the minimum percent emission reduction associated with the LSI Level the applicant is seeking verification for.
   (2) If the applicant claims a reduced emission level, the reduced emission level must not exceed the emission level associated with the LSI Level the applicant is seeking verification for.
   (3) The LSI retrofit emission control system must maintain its physical integrity. Its physical structure and all of its components not specified for regular replacement during the durability demonstration period must remain intact and fully functional.
   (4) The LSI retrofit emission control system must not cause any damage to the engine, vehicle, or equipment.
   (5) No maintenance of the LSI retrofit emission control system beyond that specified in its owner's manual will be allowed without prior Executive Officer approval.

(j) Failure during the Durability Demonstration Period. If the LSI retrofit emission control system fails to maintain its initial verified percent emission reduction or reduced emission level for any reason, the Executive Officer may downgrade the system to the verification level which corresponds to the lowest degraded performance observed in the durability demonstration period. If the LSI retrofit emission control system fails to maintain the emission reduction performance pursuant to Sections 2484(i)(1) and 2484(i)(2), as demonstrated during the initial emission test pursuant to Section 2483, during the durability period, the LSI retrofit emission control system will not be verified. If the LSI retrofit emission control system fails in the course of the durability demonstration period, the applicant must submit a report explaining the circumstances of the

failure within 90 days of the failure. The Executive Officer may then determine whether to deny verification or allow the applicant to correct the failed LSI retrofit emission control system and either continue the durability demonstration or begin a new durability demonstration.

NOTE: Authority cited: Sections 39002, 39003, 39500, 39600, 39601, 39650-39675, 40000, 43000, 43000.5, 43011, 43013, 43018 and 43105, 43600, 43700, Health and Safety Code. Reference: Sections 39650-39675, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, and 43204-43205.5 Health and Safety Code; Title 17 California Code of Regulations Section 93000.

§ 2485. Field Demonstration Requirements

(a) Compatibility. The applicant must demonstrate compatibility of its LSI retrofit emission control system in the field with at least one piece of equipment belonging to the initial emission control group for which it seeks verification. Note that if the durability demonstration selected by the applicant is in-field, it may be used to satisfy the field demonstration requirement for that emission control group.

(1) Compatibility is determined by the Executive Officer based on the third-party statement (see part (c) of this section) and any other data submitted. An LSI retrofit emission control system is compatible with the chosen application if it:

(A) Does not cause damage to the engine or engine malfunction

(B) Does not hinder or detract from the vehicle or equipment's ability to perform its normal functions

(C) Is physically intact and well mounted with no signs of leakage or other visibly detectable problems

(2) To determine whether additional emission control groups require separate field demonstrations, the Executive Officer may consider all relevant information, including, but not limited to existing field experience and engineering justification and analysis.

(b) Test Period. A piece of equipment must be operated with the LSI retrofit emission control system installed for a minimum period of 200 hours.

(c) Reporting Requirements. The applicant must provide a written statement from a third party approved by the Executive Officer, such as the owner or operator of the equipment used in the field demonstration. The written statement must be provided at the end of the test period and must describe the following aspects of the field demonstration: overall performance of the test application and the LSI retrofit emission control system, maintenance performed, problems encountered, and any other relevant information. The results of a visual inspection conducted by the third party at the end of the demonstration period must also be described. The description should comment on whether the LSI retrofit emission control system is physically

intact, securely mounted, or leaking any fluids, and should include any other evaluative observations.

(d) Failure During the Field Demonstration. The LSI retrofit emission control system would be deemed to fail the field demonstration requirements if it could not comply with the criteria specified in Section 2485 (a)(1) during the test period. If the LSI retrofit emission control system fails in the course of the field demonstration, the applicant must notify ARB within 15 days of the failure, and submit a report explaining the circumstances of the failure within 90 days of the failure. The Executive Officer may then determine whether to deny verification or allow the applicant to correct the failed LSI retrofit emission control system and either continue the field demonstration or begin a new field demonstration.

NOTE: Authority cited: Sections 39002, 39003, 39500, 39600, 39601, 39650-39675, 40000, 43000, 43000.5, 43011, 43013, 43018 and 43105, 43600, 43700, Health and Safety Code. Reference: Sections 39650-39675, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, and 43204-43205.5 Health and Safety Code; Title 17 California Code of Regulations Section 93000.

§ 2486. Other Requirements

(a) Fuel and Oil Requirements. The applicant must specify the fuel and lubricating oil requirements necessary for proper functioning of the LSI retrofit emission control system. The applicant must also specify any consequences that will be caused by failure to comply with these requirements, as well as methods for reversing any negative consequences.

(b) Maintenance Requirements. The applicant must identify all normal maintenance requirements for the LSI retrofit emission control system. The applicant must specify the recommended intervals for cleaning and/or replacing components. Any components to be replaced within the defects warranty period must be included with the original LSI retrofit emission control system package or provided free of charge to the customer at the appropriate maintenance intervals. Any normal maintenance items that the applicant does not intend to provide free of charge must be approved by the Executive Officer (the applicant is not required to submit cost information for these items). In addition, if applicable, the applicant must specify procedures for proper handling of spent components and/or materials cleaned from the LSI retrofit emission control system. If any such materials are hazardous, the applicant must identify them as such in the owner's manual.

(c) System Labeling.

(1) The applicant must ensure that a legible and durable label is affixed on both the LSI retrofit emission control system and the engine on which the LSI retrofit emission control system is installed except as noted in (3) below. The required labels must identify the name, address, and phone

number of the manufacturer, the LSI retrofit emission control system family name (defined in (2) below), a unique serial number for the LSI retrofit emission control system and the month and year of manufacture. The month and year of manufacture are not required on the label if this information can be readily obtained from the applicant by reference to the serial number. A scale drawing of a sample label must be submitted with the verification application. Unless an alternative is approved by the Executive Officer, the label information must be in the following format:

Name, Address, and Phone Number of Manufacturer
LSI Retrofit Emission Control System Family Name
Product Serial Number
ZZ-ZZ (Month and Year of manufacture, e.g., 11-05)

(2) LSI Retrofit Emission Control System Family Name. Each LSI retrofit emission control system shall be assigned a family name defined as below:

CA/MMM/YYYY/NHP## or NHL##/APP/XXXXX
Where:

CA: Designates an LSI retrofit emission control system verified in California
MMM: Manufacturer code (assigned by the Executive Officer)
YYYY: Year of verification
NHP##: Verified NOx+HC reduction percent, if any (e.g., NH75 means NOx+HC reduction of 75 percent).
NHL##: Verified NOx+HC emission level in units of g/bhp-hr, (e.g., NH3.0 means verified NOx+HC emission level of 3.0 g/bhp-hr).
APP: Verified application which may include a combination of Off-road (OF),or Stationary (ST)
XXXXX: Five alphanumeric character code issued by the Executive Officer

(3) The applicant may request that the Executive Officer approve an alternative format to the LSI retrofit emission control system or engine as described in this section. In reviewing this request, the Executive Officer may consider all relevant information including, but not limited to, the informational content of an alternative label as proposed by the applicant.

(d) Additional Information. The Executive Officer may require the applicant to provide additional information about the LSI retrofit emission control system or its implementation when such information is needed to assess environmental impacts associated with its use.

(e) Owner's Manual. The applicant must provide a copy of the LSI retrofit emission control system owner's manual, which must clearly specify at least the following information:
(1) Warranty statement including the warranty period over which the applicant is liable for any defects.
(2) Installation procedure and maintenance requirements for the LSI retrofit emission control system.
(3) Fuel consumption penalty, if any.
(4) Fuel requirements, if any.
(5) Requirements for lubrication oil quality and maximum lubrication oil consumption rate
(6) Contact information for replacement components and cleaning agents.

(f) Noise Level Control. Applicants must ensure that the LSI retrofit emission control system complies with all applicable noise limits for which the LSI retrofit emission control system is intended. All LSI retrofit emission control systems must be in compliance with applicable local government requirements for noise control.

(g) Limit on CO. In order for an LSI retrofit emission control system to be verified, the LSI retrofit emission control system must either:
(1) Not increase the emissions of CO greater than the current CO emission standards for new, emission-certified, LSI engines adopted by the Air Resources Board and in effect at the time of verification; Or
(2) Not increase the emissions for CO by more than 10 percent of the baseline emission level for uncontrolled engines as reported under Section 2488 (a).

(h) Emission Sampling Ports. To facilitate in-field emission measurements, the applicant should design the LSI retrofit emission control system to have a minimum of two sampling ports where emissions measurements could be made.
(1) The sampling ports should be designed to allow for measurements of uncontrolled, engine-out emissions and controlled, tailpipe emissions;
(2) The sampling ports should be ¼ inch NPT half couplings, either welded to the exhaust system, or manufactured into the emission control device where possible;
(3) The sampling port to be used for measuring uncontrolled, engine-out emissions should be located in a straight section of the exhaust pipe upstream from the emission control device, after the turbocharger, if so equipped, with a minimum of one to two pipe diameters from any elbows upstream of the sampling port. It is acceptable to locate the sampling port adjacent to the oxygen sensor threaded port, if so equipped;
(4) The sampling port to be used for measuring controlled, tailpipe emissions should be placed on the muffler body, after the catalyst, if so equipped, or if in the exhaust pipe, should be located a minimum distance of 10 inches

from the tailpipe opening, if feasible, otherwise, it should be located as far as possible from the tailpipe opening;

(5) The locations of the sampling ports should be designed to be accessible to test personnel without removing major engine or equipment components, such as the forklift counterweight, for example;

(6) The sampling ports should be equipped with threaded plugs.

(7) If the sampling ports are designed to be installed by the retrofit system installer, the applicant must provide all necessary parts and complete instructions for proper installation;

NOTE: Authority cited: Sections 39002, 39003, 39500, 39600, 39601, 39650-39675, 40000, 43000, 43000.5, 43011, 43013, 43018 and 43105, 43600, 43700, 43830.8, Health and Safety Code. Reference: Sections 39650-39675, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, 43204-43205.5, and 43830.8 Health and Safety Code; Section 71017 Public Resources Code; Title 17 of Regulations Section 93000.

§ 2487. Warranty Requirements

(a) (1) Product Warranty.

(A) The applicant must warrant to all owners, for ownership within the warranty period, and lessees, for lease contract within the warranty period, that its verified LSI retrofit emission control system is free from defects in design, materials, workmanship, or operation of the LSI retrofit emission control system which cause the LSI retrofit emission control system to fail to conform to at least 90 percent of the lower bound of its initial verification level for the minimum warranty period of 3 years or 2,500 hours, provided the operation of and conditions of use for the equipment, engine, and LSI retrofit emission control system conform with the operation and conditions specified in the ARB's Executive Order.

(B) In the absence of a device to measure hours of use, the LSI retrofit emission control system must be warranted for a period of three years. If a device to measure hours is used, the engine must be warranted for 3 years or 2,500 hours, whichever occurs first. The warranty must cover the full repair or replacement cost of the LSI retrofit emission control system, including parts and labor.

(C) The warranty must also cover the full repair or replacement cost of returning the engine components to the condition they were in prior to the failure, including parts and labor, for damage to the engine proximately caused by the verified LSI retrofit emission control system. Repair or replacement of any warranted part, including the engine, must be performed at no charge to the equipment or engine owner. This includes only those relevant diagnostic expenses in the case in which a warranty claim is valid. The applicant may, at its option, instead pay the fair market value of the engine prior to the time the failure occurs.

(D) The repair or replacement of any warranted part otherwise eligible for warranty coverage, may be excluded from such warranty if the LSI retrofit emission control system or engine has been abused, neglected, or improperly maintained, and such abuse, neglect, or improper maintenance was the direct cause of the need for the repair or replacement of the part.

(E) Failure of the equipment or engine owner to ensure scheduled maintenance or to keep maintenance records for the equipment, engine, or LSI retrofit emission control system may, but shall not per se, be grounds for disallowing a warranty claim.

(a) (2) Installation Warranty

(A) A person or company who installs a verified LSI retrofit emission control system must warrant that the installation is free from defects in workmanship or materials which cause the LSI retrofit emission control system to fail to conform to the emission control performance level it was verified to or the other requirements of sections 2480-2486 for 3 years or 2,500 hours, whichever occurs first.

(B) The extent of the warranty coverage provided by installers must be the same as the warranty provided by the applicant as established in subsection (a)(1) and the same exclusions must apply.

(b)(1) Product Warranty Statement. The applicant must furnish a copy of the following statement in the owner's manual. The applicant may include descriptions of circumstances that may result in a denial of warranty coverage, but these descriptions shall not limit warranty coverage in any way.

YOUR WARRANTY RIGHTS AND OBLIGATIONS

(Applicant's name) must warrant the LSI retrofit emission control system in the application for which it is sold or leased to be free from defects in design, materials, workmanship, or operation of the LSI retrofit emission control system which cause the LSI retrofit emission control system to fail to conform to the emission control performance level it was verified to, or to the requirements in the California Code of Regulations, Title 13, Chapter 9, Article 8, Sections 2480 to 2486, and 2489, for 3 years or 2,500 hours,

pursuant to Section 2487(a)(1), provided there has been no abuse, neglect, or improper maintenance of your LSI retrofit emission control system, engine or equipment, as specified in the owner's manuals. Where a warrantable condition exists, this warranty also covers the engine from damage caused by the LSI retrofit emission control system, subject to the same exclusions for abuse, neglect or improper maintenance. Please review your owner's manual for other warranty information. Your LSI retrofit emission control system may include a core part (e.g., three-way catalyst, carburetor, mixer or regulator) as well as hoses, connectors, and other emission-related assemblies. Where a warrantable condition exists, (applicant's name) will repair or replace your LSI retrofit emission control system at no cost to you including diagnosis, parts, and labor.

WARRANTY COVERAGE:

For a (engine size) engine used in a(n) (type of application) application, the warranty period will be 3 years or 2,500 hours of operation, whichever occurs first. If any emission-related part of your LSI retrofit emission control system is defective in design, materials, workmanship, or operation of the LSI retrofit emission control system thus causing the LSI retrofit emission control system to fail to conform to the emission control performance level it was verified to, or to the requirements in the California Code of Regulations, Title 13, Chapter 9, Article 8, Sections 2480 to 2486, and 2489, within the warranty period, as defined above. (Applicant's name) will repair or replace the LSI retrofit emission control system, including parts and labor.

In addition, (applicant's name) will replace or repair the engine components to the condition they were in prior to the failure, including parts and labor, for damage to the engine proximately caused by the verified LSI retrofit emission control system. This also includes those relevant diagnostic expenses in the case in which a warranty claim is valid. (Applicant 's name) may, at its option, instead pay the fair market value of the engine prior to the time the failure occurs.

OWNER'S WARRANTY RESPONSIBILITY

As the (engine, equipment) owner, you are responsible for performing the required maintenance described in your owner's manual. (Applicant's name) recommends that you retain all maintenance records and receipts for maintenance expenses for your engine or equipment, and LSI retrofit emission control system. If you do not keep your receipts or fail to perform all scheduled maintenance, (applicant's name) may have grounds to deny warranty coverage. You are responsible for presenting your equipment or engine, and LSI retrofit emission control system to (applicant's name) or a (applicant's name) dealer as soon as a problem is detected. The warranty repair or replacement should be completed in a reasonable amount of time, not to exceed 30 days. If a replacement is needed, this may be extended to

90 days should a replacement not be available, but must be performed as soon as a replacement becomes available.

If you have questions regarding your warranty rights and responsibilities, you should contact (Insert chosen applicant's contact) at 1-800-xxx-xxxx or the California Air Resources Board at 9528 Telstar Avenue, El Monte, CA 91731, or (800) 363-7664, or electronic mail: helpline@arb.ca.gov.

(b)(2) Installation Warranty Statement. The installer must furnish the owner with a copy of the following statement.

YOUR WARRANTY RIGHTS AND OBLIGATIONS

(Installer's name) must warrant that the installation of an LSI retrofit emission control system is free from defects in workmanship or materials which cause the LSI retrofit emission control system to fail to conform to the emission control performance level it was verified to, or to the requirements in the California Code of Regulations, Title 13, Sections 2481 to 2486 and 2489. The warranty period and the extent of the warranty coverage provided by (installer's name) must be the same as the warranty provided by the product manufacturer, and the same exclusions must apply.

OWNER'S WARRANTY RESPONSIBILITY

As the engine or equipment owner, you are responsible for presenting your engine or equipment and LSI retrofit emission control system to (installer's name) as soon as a problem with the installation is detected.

If you have questions regarding your warranty rights and responsibilities, you should contact (Insert chosen installer's contact) at 1-800-xxx-xxxx or the California Air Resources Board at 9528 Telstar Avenue, El Monte, CA 91731, or (800) 363-7664, or electronic mail: helpline@arb.ca.gov.

(c) LSI Retrofit Emission Control System Warranty Report. The applicant must submit a warranty report to the Executive Officer by February 1 of each calendar year. The applicant must also submit a warranty report within 30 calendar days if the total warranty claims exceed 3 claims, or four percent whichever is greater of the number of LSI retrofit engines using the LSI retrofit emission control system. The warranty report must include the following information:

(1) Annual and cumulative sales, and annual and cumulative leases of equipment installed with LSI retrofit emission control systems—(California only).

(2) Annual and cumulative production of LSI retrofit emission control systems (California only).

(3) Annual summary of warranty claims (California only). The summary must include:

(A) A description of the nature of the claims and of the warranty replacements or repairs. The applicant must categorize warranty claims for each LSI retrofit emission control system group by the component(s) part number(s) replaced or repaired.
(B) The number and percentage of LSI retrofit emission control systems of each model for which a warranty replacement or repair was identified.
(C) A short description of the LSI retrofit emission control system component that was replaced or repaired under warranty and the most likely reason for its failure.

(4) Date the warranty claims were filed and the engine family and application the LSI retrofit emission control systems were used with.
(5) Delineate the reason(s) for any instances in which warranty service is not provided to end-users that file warranty claims.

NOTE: Authority cited: Sections 39002, 39003, 39500, 39600, 39601, 39650-39675, 40000, 43000, 43000.5, 43011, 43013, 43018 and 43105, 43600, 43700, Health and Safety Code. Reference: Sections 39650-39675, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, and 43204-43205.5 Health and Safety Code; Title 17 California Code of Regulations Section 93000.

§ 2488. Determination of Emissions Reduction

(a) Calculation of Emissions Reduction. The emissions reduction verified for an LSI retrofit emission control system is based on the average of all valid test results, as specified in Sections 2483(g) and 2483(h), before (baseline) and after (control) implementation of the LSI retrofit emission control system. Test results from both the initial emission testing and durability testing are to be used. If the applicant chooses to perform either the initial or the final durability baseline test, but not both, it must use those results to calculate the reductions obtained in both the initial and final control tests.
(1) Percentage Reduction. The percentage reduction for a given pair of baseline and control test sets (where a "set" consists of all test cycle repetitions) is the difference between the average baseline and average control emissions divided by the average baseline emissions, multiplied by 100 percent. The average of all such reductions, as shown in the equation below, is used in the verification of an LSI retrofit emission control system.

$$\text{Percentage Reduction} = 100 \times \frac{\Sigma\left[(\text{baseline}_{AVG} - \text{control}_{AVG})/\text{baseline}_{AVG}\right]}{\text{Number of control test sets}}$$

Where:

Σ = sum over all control test sets

$baseline_{AVG}$ or $control_{AVG}$ = average of emissions from all baseline or control test repetitions within a given set

(2) Absolute Emission Level. The absolute emission level is the average control emission level, as defined in the following equation:

$$\text{Absolute Emission Level} = \frac{\Sigma\ (\ control_{AVG})}{\text{Number of control test sets}}$$

(b) Categorization of the LSI retrofit emission control system. The Executive Officer shall categorize LSI retrofit emission control system to reduce NOx and HC emissions based on their verified emission reductions. LSI retrofit emission control system that reduce NOx and HC will be assigned their verified percentage reduction in five percent increments, or verified emission reduction level, in 0.5 g/bhp-hr decrements.

NOTE: Authority cited: Sections 39002, 39003, 39500, 39600, 39601, 39650-39675, 40000, 43000, 43000.5, 43011, 43013, 43018 and 43105, 43600, 43700, Health and Safety Code. Reference: Sections 39650-39675, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, and 43204-43205.5 Health and Safety Code; Title 17 California Code of Regulations Section 93000.

§ 2489. In-Use Compliance Requirements

(a) Applicability. These in-use compliance requirements apply to all LSI retrofit emission control strategies for off-road applications. It is the responsibility of the applicant to perform in-use compliance testing for each verified LSI retrofit emission control system family. Testing is required when 50 units within a given LSI retrofit emission control system family have been sold or leased in the California market.

(b) Applicants must obtain and test LSI retrofit emission control systems, as described below in (c), (d), and (e), once they have been operated between 1,500 and 2,000 hours or between 22 and 29 months, whichever comes first.

(c) Selection of LSI Retrofit Emission Control Systems for Testing. For each LSI retrofit emission control system family, the Executive Officer will identify a representative sample of engines or equipment equipped with LSI retrofit emission control systems for in-use compliance testing. The engines or equipment equipped with the selected LSI retrofit emission control systems must have good maintenance records and may receive a tune-up or normal maintenance prior to testing. The applicant must obtain information from the end users regarding the accumulated hours of usage, maintenance records (to the extent practicable), operating conditions and a description of any unscheduled maintenance that may affect the emission results. If the

specified information is not available for the engine or equipment selected, the Executive Officer may select a different engine or equipment for testing. Upon notification that an engine or equipment has been selected, an applicant would have 6 months to provide an in-use compliance testing proposal for approval by the Executive Officer. Testing would begin when the engines had accumulated sufficient hours of service; testing must be completed within one year of notification.

(d) Number of LSI Retrofit Emission Control Systems to be Tested. The number of LSI retrofit emission control systems an applicant must test will be determined as follows:
(1) A minimum of four LSI retrofit emission control systems in each LSI retrofit emission control system family must be tested. For every system tested that does not reduce emissions by at least 90 percent of the lower bound of its initial verification level, two more LSI retrofit emission control systems from the same family must be obtained and tested. The total number of systems tested shall not exceed ten per LSI retrofit emission control system family.
(2) At the discretion of the Executive Officer, applicants may begin by testing more than the minimum of four LSI retrofit emission control systems. Applicants may concede failure of an emission control system before testing a total of ten LSI retrofit emission control systems.

(e) In-use Compliance Emission Testing. Measure emissions using one of the following test procedures:
(1) Remove the selected engines or the retrofit emission control systems for testing in a laboratory. Applicants must follow the testing procedure used for initial emission reduction verification as described in Section 2483. For engines originally verified to a percentage reduction, both baseline and control tests are required; for engines originally verified to an emission level, only control tests are required. In addition, applicants must use the same test cycle(s) that they used to verify the LSI retrofit emission control system originally.
(2) Test the selected engines while they remain installed in the equipment. Applicants must follow the U.S. EPA field-testing procedures as specified in 40 CFR part 1065, subpart J. The accuracy and precision of the measurement system used for in-use testing must be at least $\pm$5 percent or better. For engines originally verified to a percentage reduction, both baseline and control tests are required; for engines originally verified to an emission level, only control tests are required.
(3) The Executive Officer may approve an alternative to the in-use testing described above, on a case-by-case basis, if such testing is overly burdensome to either the applicant or to the end-users due to the nature of the industry the particular LSI retrofit emission control systems are used in. The proposed alternative must use scientifically-sound methodology and be designed to determine whether the LSI retrofit emission control

system is in compliance with the emission reductions the Executive Officer verified it to. If the applicant wants to use an alternative in-use test procedure, the applicant must submit the proposed alternative in-use test procedure at the same time the applicant submits the proposed verification testing protocol (pursuant to Section 2482(b) for LSI retrofit control system verification. If the applicant proposed an alternative test to determine in-use emissions of the LSI retrofit system, the applicant must provide data to correlate the emissions from the proposed alternative test to the engine dynamometer test using test cycle(s) that was used in the initial verification of the LSI retrofit system.

(f) If an LSI retrofit emission control system fails catastrophically during the in-use compliance testing, the applicant must provide an investigative report detailing the causes of the failure to the Executive Officer within 90 days of the failure.

(g) The Executive Officer may, with respect to any LSI retrofit emission control system sold, leased, offered for sale, or manufactured for sale in California, order the applicant or retrofit manufacturer to make available for compliance testing and/or inspection a reasonable number of LSI retrofit emission control systems, and may direct that they be delivered at the applicant's expense to the state board at the Haagen-Smit Laboratory, 9528 Telstar Avenue, El Monte, California or where specified by the Executive Officer. The Executive Officer may also, with respect to any LSI retrofit emission control system being sold, leased, offered for sale, or manufactured for sale in California, have an applicant compliance test and/or inspect a reasonable number of units at the applicant or manufacturer's facility or at any test laboratory under the supervision of the ARB Executive Officer.

(h) In-Use Compliance Report. The applicant must submit an in-use compliance report to the Executive Officer within three months of completing each phase of testing. The following information must be reported for each of the minimum of four LSI retrofit emission control systems tested:
(1) Parties involved in conducting the in-use compliance tests.
(2) Quality control and quality assurance information for the test equipment.
(3) LSI retrofit emission control system family name and manufacture date.
(4) Equipment and type of engine (engine family name, make, model year, model, displacement, etc.) the LSI retrofit emission control system was applied to.
(5) Estimated hours the LSI retrofit emission control system was in use.
(6) Results of all emission testing.
(7) Summary of all maintenance, adjustments, modifications, and repairs performed on the LSI retrofit emission control system.

(i) The Executive Officer may request the applicant to perform additional in-use testing if the warranty claims exceed 3, or four percent of the number of LSI

retrofit engines using the LSI retrofit emission control system, whichever is greater, or based on other relevant information. As noted in Section 2487(c), if warranty claims exceed four percent of the number of LSI retrofit engines using the LSI retrofit emission control system, the applicant must notify the Executive Officer and submit a warranty report within 30 calendar days of that time.

(j) Conditions for Passing In-Use Compliance Testing. For an LSI retrofit emission control system to pass in-use compliance testing, emission test results must indicate that the retrofit system reduced emissions by at least 90 percent of the lower bound of the emission reduction level the Executive Officer originally verified it to. If the first four LSI retrofit emission control systems tested within an LSI retrofit emission control system family meet this standard, the LSI retrofit emission control system passes in-use compliance testing. If any of the first four LSI retrofit emission control systems tested within an LSI retrofit emission control system family fail to reduce emissions by at least 90 percent of the lower bound of the emission reduction level the Executive Officer originally verified it to, and if more than four units are tested, at least 70 percent of all units tested must pass the 90 percent standard for the LSI retrofit emission control system family to pass in-use compliance testing. For each failed test, for which the cause of failure can be attributed to the product and not to maintenance or other engine-related problems, two additional units must be tested, up to a total of ten units per LSI retrofit emission control system family.

(k) Failure of In-use Compliance Testing. If an LSI retrofit emission control system family does not meet the minimum requirements for compliance, the applicant must submit a remedial report within 90 days after the in-use compliance report is submitted. The remedial report must include:
(1) Summary of the in-use compliance report.
(2) Detailed analysis of the failed LSI retrofit emission control systems and possible reasons for failure.
(3) Remedial measures to correct or replace failed LSI retrofit emission control systems as well as the rest of the in-use LSI retrofit emission control systems.

(l) The Executive Officer may evaluate the remedial report, annual warranty report, and all other relevant information to determine if the LSI retrofit emission control system family passes in-use compliance testing. The Executive Officer may request more information from the applicant. Based on this review, the Executive Officer may lower the verification level or revoke the verification status of a verified LSI retrofit emission control system family. The Executive Officer may also lower the verification level or revoke the verification status of a verified LSI retrofit emission control system family, if the applicant does not conduct in-use compliance testing in accordance with this section, or if the Executive Officer conducts in-use compliance testing in

accordance with this section (including alternative testing) and the LSI retrofit emission control system family does not pass the standards in this section.

(m) The Executive Officer may lower the verification level or revoke the verification status of a verified LSI retrofit emission control system family if the applicant fails to observe the requirements of Sections 2486 or 2487. The Executive Officer must allow the applicant an opportunity to address the possible lowering or revocation of the verification level in a remedial report to the Executive Officer and the Executive Officer may make this determination based on all relevant information.

NOTE: Authority cited: Sections 39002, 39003, 39500, 39600, 39601, 39650-39675, 40000, 43000, 43000.5, 43011, 43013, 43018 and 43105, 43600, 43700, Health and Safety Code. Reference: Sections 39650-39675, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, and 43204-43205.5 Health and Safety Code; Title 17 California Code of Regulations Section 93000.